REMARKS

The Final Office Action dated December 17, 2003, has been received and carefully noted. The RCE submitted herewith along with the amendments and the following remarks are submitted as a full and complete response thereto.

Claims 1-5, 7-9, and 12-14 have been amended. New claims 16-26 have been added. Applicants submit that the new claims as well as the amendments made herein are fully supported in the specification and the drawings as originally filed, and therefore no new matter has been added. Accordingly, claims 1-9, 12-14 and 16-26 are pending in the present application and are respectfully submitted for consideration.

Claims 2, 4 and 8 were objected to for failing to further limit the subject matter of a previous claim. As mentioned above, claims 2, 4 and 8 have been amended to overcome the objection, and therefore Applicants submit that claims 2, 4 and 8 are in full compliance with US patent practice.

Claims 1-5, 7-9, 12 and 13 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Sato et al. (US Patent No. 5,861,601, hereinafter "Sato") in view of Otsubo et al. (US Patent No. 4,985,109, hereinafter "Otsubo"). Applicants respectfully submit that each of claims 1-5, 7-9, 12 and 13 recites subject matter that is neither disclosed nor suggested by the cited prior art.

Claim 1 recites a plasma processing apparatus for processing an object using a plasma. The apparatus includes a processing chamber defining a processing cavity for containing an object to be processed and a process gas therein, a microwave radiating antenna having a microwave radiating surface for radiating a microwave in order to

excite a plasma in the processing cavity, and a dielectric body provided so as to be opposed to the microwave radiating surface. A distance D between the microwave radiating surface and a surface of the dielectric body facing away from the microwave radiating surface, which is represented with a wavelength of the microwave being a distance unit, is determined to be in a range satisfying an inequality $0.7 \times n/4 \leqq D \leqq 1.3 \times n/4$ (n being a natural number). Also, a standing wave of the microwave is formed between the microwave radiating surface and a plasma exciting surface, thereby exciting a plasma at the plasma exciting surface by being supplied with energy from the standing wave of the microwave, the plasma exciting surface substantially coinciding with the surface of the dielectric body facing away from the microwave radiating surface, the plasma being formed between the plasma exciting surface and the object to be processed, the standing wave not entering the plasma.

Claim 2 recites a plasma processing apparatus for processing an object using a plasma including at least a distance D between the microwave radiating surface and a surface of the dielectric body facing away from the microwave radiating surface, which is represented with a wavelength of the microwave being a distance unit, is determined to be in a range satisfying an inequality $0.7 \times n/2 \leqq D \leqq 1.3 \times n/2$ (n being a natural number).

Claim 7 recites a plasma processing method for processing an object using a plasma. The method includes the steps of putting an object to be processed and a process gas into a processing cavity defined in a processing chamber, radiating a microwave for exciting a plasma from a microwave radiating antenna having a

microwave radiating surface to the processing cavity, providing a dielectric body so as to be opposed to the microwave radiating surface, and determining a distance D between the microwave radiating surface and a surface of the dielectric body facing away from the microwave radiating surface, which is represented with a wavelength of the microwave being a distance unit, to be in a range satisfying an inequality $0.7 \times n/4 \leqq D \leqq 1.3 \times n/4$ (n being a natural number), whereby a standing wave of the microwave is formed between the microwave radiating surface and a plasma exciting surface, thereby exciting a plasma at the plasma exciting surface by being supplied with energy from the standing wave of the microwave, the plasma exciting surface substantially coinciding with the surface of the dielectric body facing away from the microwave radiating surface, the plasma being formed between the plasma exciting surface and the object to be processed, the standing wave not entering the plasma.

Claim 8 recites a plasma processing method having at least the step of determining a distance D between the microwave radiating surface and a surface of the dielectric body facing away from the microwave radiating surface, which is represented with a wavelength of the microwave being a distance unit, to be in a range satisfying an inequality $0.7 \times n/2 \leqq D \leqq 1.3 \times n/2$ (n being a natural number).

Accordingly, at least one of the essential features of the present invention is a standing wave of the microwave that is formed between the microwave radiating surface and a plasma exciting surface, thereby exciting a plasma at the plasma exciting surface by being supplied with energy from the standing wave of the microwave, the plasma exciting surface substantially coinciding with the surface of the dielectric body

facing away from the microwave radiating surface, the plasma being formed between the plasma exciting surface and the object to be processed, the standing wave not entering the plasma. As such, the present invention results in the advantage of having a plasma processing apparatus capable of generating a high density plasma.

It is respectfully submitted that the prior art fails to disclose or suggest the elements of the Applicants' invention as set forth in claims 1-5, 7-9, 12 and 13, and therefore fails to provide the advantages that are provided by the present application.

Sato merely discloses a microwave plasma processing apparatus of an electron cyclotron resonance (ECR) system. In the ECR system, microwaves are not reflected around the lower surface of a quartz plate, which forms a microwave introduction window because only a weak plasma is produced around a lower surface of the quartz plate. Therefore, no standing wave of the microwave is formed between a slot antenna and the quartz plate.

Otsubo discloses a plasma processing apparatus that generates plasma according to a cavity resonance system. However, Otsubo fails to disclose that a standing wave of the microwave that is formed between the microwave radiating surface and a plasma exciting surface, thereby exciting a plasma at the plasma exciting surface by being supplied with energy from the standing wave of the microwave, the plasma exciting surface substantially coinciding with the surface of the dielectric body facing away from the microwave radiating surface, the plasma being formed between the plasma exciting surface and the object to be processed, the standing wave not entering the plasma, as defined by the claimed invention. In particular, Otsubo merely

disclose that a standing wave of microwave is formed between a slot plate 5 and a stage 7 holding a substrate 12, in between which a quartz plate 4 is disposed. It is submitted that the lower surface of the quartz plate 4 of Otsubo is neither comparable nor analogous to the plasma exciting surface of the present invention since Outsubo discloses a microwave radiating surface of the slot plate 5.

Accordingly, Applicants submit that neither Sato nor Otsubo, taken together or in combination, disclose or suggest each and every element recited in claims 1, 2, 7 and 8 of the present application, and therefore is allowable.

As for claims 3-5, 9, 12 and 13, it is submitted that each of these claims is dependent on independent claims 1, 2 and 7, respectively. As such, each of claims 3-5, 9, 12 and 13 is allowable due to its dependency on allowable claims 1, 2 and 7.

Claim 6 was rejected under 35 U.S.C. §103(a) as being unpatentable over Sato in view of Tsuchihashi et al. (US Patent No. 6,109,208, hereinafter "Tsuchihashi"). Additionally, claim 14 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Sato in view of Otsubo, and further in view of Tsuchihashi. Applicants respectfully submit that each of claims 6 and 14 recites subject matter that is neither disclosed nor suggested by the cited prior art.

Each of claims 6 and 14 is dependent on independent claims 1 and 7, respectively. As such, each of claims 6 and 14 is allowable due to its dependency on allowable claims 1 and 7.

As for new claims 16-26, Applicants respectfully submit that each of new claims 16-26 recites subject matter that is neither disclosed nor suggested by the cited prior

art. In particular, it is submitted that neither Sato, Otsubo and/or Tsuchihashi, taken alone or in combination, disclose or suggest at least the subject matter of a radial line slot antenna in combination with the distance D between the microwave radiating surface of the antenna and a surface of a dielectric body as recited in claims. Radial line slot antenna of the present invention have a number of line-shaped slots formed and distributed on a conductor surface as arranged in a spiral pattern or a concentric pattern. In contrast, Otsubo's antenna has arc-shaped slots, but does not have slots in the form of straight lines.

By using a radial line slot antenna of the present invention, strong plasma is generated just beneath the dielectric body, where microwaves are reflected. Therefore, by determining the distance between the antenna and a lower surface of the dielectric body based on the wavelength of the microwave, standing wage of microwave can be formed between the antenna and a lower surface of the dielectric body. Accordingly, the standing wave of the present invention does not enter the plasma formed between the lower surface of the dielectric body and the object to be processed. Thus, Applicants submit that the cited prior art fails to disclose or suggest each and every element recited in claims 16-26, and therefore is allowable.

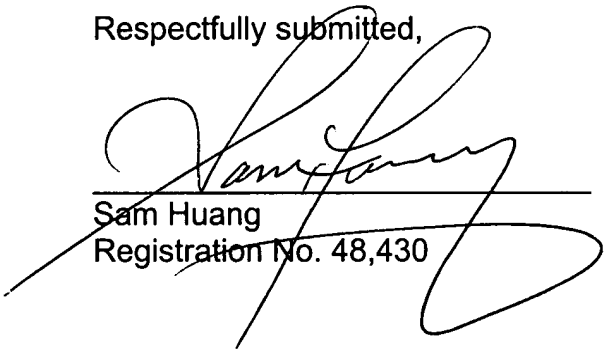
In view of the above, Applicants respectfully submit that each of claims 1-9, 12-14 and 16-26 recites subject matter that is neither disclosed nor suggested in the cited prior art. Applicants also submit that the subject matter is more than sufficient to render the claims non-obvious to a person of ordinary skill in the art, and therefore respectfully

request that claims 1-9, 12-14 and 16-26 be found allowable and that this application be passed to issue.

If for any reason, the Examiner determines that the application is not now in condition for allowance, it is respectfully requested that the Examiner contact the Applicants' undersigned attorney at the indicated telephone number to arrange for an interview to expedite the disposition of this application.

In the event this paper has not been timely filed, the Applicants respectfully petition for an appropriate extension of time. Any fees for such an extension, together with any additional fees that may be due with respect to this paper, may be charged to counsel's Deposit Account No. 01-2300.

Respectfully submitted,



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Enclosures: Petition for Extension of Time (One month)
RCE Transmittal
Extra Claims Transmittal